REMARKS

In view of the following discussion, the Applicants submit that none of the claims now pending in the application is anticipated under the provisions of 35 U.S.C. § 102 or made obvious under the provisions of 35 U.S.C. § 103. Thus, the Applicants believe that all of these claims are now in allowable form.

I. OBJECTIONS TO CLAIMS 1, 17 AND 20

Claims 1, 17 and 20 stand objected to for informalities. In response, the Applicants have amended claims 1, 17 and 20 in order to more clearly recite aspects of the present invention.

In particular, the preambles of claims 1 and 20 and the body of claim 17 have been amended to recite, "a channel that transmits at at least at a nominal bandwidth", replacing "a channel capable of transmission at a nominal bandwidth". Claim 17 has been further amended to recite, "a router node that supports differentiated services", replacing "a router node capable of supporting differentiated services".

In light of these amendments, the Applicants respectfully request that the objection to claims 1, 17 and 20 be withdrawn.

II. REJECTION OF CLAIMS 1-3, 5-9, 13-20 AND 21 UNDER 35 U.S.C. § 102

The Examiner has rejected claims 1-3, 5-9, 13-20 and 21 under 35 U.S.C. §102(e) as being anticipated by the Li et al. patent (United States Patent No. 6,738,819, issued on May 18, 2004, hereinafter "Li"). The Applicants respectfully traverse the rejection.

Li teaches a method and apparatus for assuring Quality of Service (QoS) over links of an Internet Protocol (IP) network with differentiated services (DiffServ) capabilities. Specifically, Li teaches a method whereby, for each link, a finite amount of bandwidth is allocated among a plurality of defined packet service classes (*e.g.*, "best effort", "expedited forwarding", "assured forwarding", etc.). To meet delay or loss of packet objectives, the capacity allocated to a particular service class is utilized up to a pre-determined maximum allowable capacity. For a service class with tight

requirements on delay and loss, this maximum allowable capacity is less than the actual bandwidth allocated to the service class. For a service class with looser or no such requirements, this maximum allowable capacity is closer to the actual bandwidth allocated to the service class. Thus, in essence, a service class will almost never use 100% of its allocated bandwidth.

The Examiner's attention is directed to the fact that Li fails to teach, show or suggest a method for transmitting packets wherein at least one of: a packet class's nominal packet departure rate and the class's minimum allocation of available bandwidth is dynamically changeable, as recited by the Applicants' independent claims 1, 17 and 20. In particular, the Applicants' claims 1, 17 and 20 positively recite:

> 1. In a network comprising a plurality of router nodes connected in the network by communication links, a method of providing quality of service assurances for transmitting packets over a channel that transmits at at least at a nominal bandwidth, the method comprising:
> defining a plurality of classes, each of the classes representing an aggregate behavior of packets;
> allocating to each of the classes a nominal departure rate at which the packets of that class are transmitted when an available bandwidth of the channel is substantially operating at the nominal bandwidth; and
> assuring each of the classes a minimum allocation of the available bandwidth for transmitting packets of that class if the available bandwidth of the channel is operating at less than the nominal bandwidth,
> wherein at least one of: the nominal departure rate or the minimum allocation is dynamically changeable. (Emphasis added)

> 17. In a network, a router node that supports differentiated services, the router node comprising:
> a classifier defining a plurality of classes, each of the classes representing an aggregate behavior of packets;
> an allocater allocating to each of the classes a nominal departure rate at which the packets of that class are transmitted when an available bandwidth of a channel that transmits at at least at a nominal bandwidth is substantially operating at the nominal bandwidth; and
> a rate prioritizer assigning each of the classes a minimum allocation of the available bandwidth for transmitting packets of that class if the available bandwidth of the channel is operating at less than the nominal bandwidth,
> wherein at least one of: the nominal departure rate or the minimum allocation is dynamically changeable. (Emphasis added)

20. An article of manufacture having computer-readable program means embodied thereon for providing quality of service assurances for transmitting packets over a channel that transmits at at least at a nominal bandwidth, the article comprising:

computer-readable means for defining a plurality of classes, each of the class classes representing an aggregate behavior of packets;

computer-readable means for allocating to each of the classes a nominal departure rate at which the packets of that class are transmitted when an available bandwidth of the channel is substantially operating at the nominal bandwidth; and

computer-readable means for assuring each of the classes a minimum allocation of the available bandwidth for transmitting packets of that class if the available bandwidth of the channel is operating at less than the nominal bandwidth,

wherein at least one of: the nominal departure rate or the minimum allocation is dynamically changeable. (Emphasis added)

The Applicants' invention is directed to a per hop behavior for DiffServ in mobile ad hoc wireless networks. Conventional best effort service models for assuring QoS tend to be inadequate for many applications, especially those implemented in wireless networks. In particular, the dynamic nature of wireless network topologies (*e.g.*, due to the mobility of the linked devices) and the peculiarities of signal propagation over wireless links (which tend to cause frequent changes to the states of the links) often cause a wireless network to be subject to higher data losses and more frequent bandwidth reallocations than traditional wired networks.

The Applicants' invention attempts to address this inadequacy by providing a per hop behavior for differentiated services in mobile ad hoc wireless networks. For example, in one embodiment, the Applicants provide a method whereby bandwidth for a link capable of transmission at a nominal bandwidth is allocated among a plurality of packet classes. At any given time, the specific amount of bandwidth allocated to a given class depends on how much of the nominal bandwidth is being consumed. Thus, each class is associated with: (1) a nominal departure rate at which the packets of that class are transmitted when an available bandwidth of the channel is substantially operating at the nominal bandwidth; and (2) a minimum allocation of the available

bandwidth for transmitting packets of that class if the available bandwidth of the channel is operating at less than the nominal bandwidth. Either or both of the nominal departure rate and the minimum allocation of the available bandwidth is dynamically changeable, such that it/they may be adjusted to compensate for changing bandwidth availability resulting from changing network topology (*e.g.*, changes in link conditions). Thus, the Applicants' invention may be particularly well-suited for implementation in applications for wireless links and/or highly mobile networked devices.

By contrast, Li teaches a method in which <u>a maximum allocation of bandwidth (admit limit) is measured for incoming requests</u>. Thus, Li does not teach, show or suggest a method for attaining per-hop behavior for a plurality of classes of packet traffic in which a <u>nominal departure rate</u> and/or a <u>minimum bandwidth allocation</u> for individual packet classes is <u>dynamically changeable</u>.

The Examiner equates the allocated link bandwidth taught by Li with the Applicants' allocated nominal departure rate and equates the maximum allowable capacity taught by Li with the Applicants' minimum allocation of available bandwidth. The Applicants respectfully disagree with this characterization. Specifically, the Applicants submit that the nominal departure rate and the minimum allocation of bandwidth each represent a <u>minimum amount</u> or <u>lower limit</u> of bandwidth dedicated to a given class, depending on whether the associated link is operating under "normal" conditions or "degraded" conditions (*e.g.*, due to reduced resources) – a class will receive <u>no less than</u> this amount of bandwidth, <u>but may receive more depending on resource availability</u>. The allocated link bandwidth and maximum allowable capacity taught by Li represent a <u>maximum amount</u> or <u>upper limit</u> of bandwidth dedicated to a given class, where the difference between the allocated link bandwidth and maximum allowable capacity reflects the tightness of delay and loss requirements for that class – a class can receive <u>no more than</u> this bandwidth, <u>but may receive less depending on the class's requirements</u> (*See*, Li, column 5, lines 64-65: "A service request is accepted <u>if the required bandwidth does not exceed the admit limit (AL)</u>", emphasis added). Thus, Li does not teach or suggest allocating a nominal departure rate or a minimum allocation of bandwidth, but <u>at most</u> teaches measuring a maximum allowable

bandwidth.

However, even assuming that the Applicants' nominal departure rate/minimum allocation of bandwidth may be equated with Li's allocated link bandwidth/maximum allowable capacity, Li still does not teach or suggest every limitation of the Applicants' claimed invention, because Li does not teach or suggest that the allocated link bandwidth and/or maximum allowable capacity is dynamically changeable. The portions of Li that the Examiner cites to support this assertion at most teach that Li is capable of dynamically adjusting the amount of new traffic that the network is configured to accept, based on current utilization of allocated resources. That is, Li teaches identifying a link having the smallest remaining capacity (bandwidth) and updating a metric to reflect the value of this smallest remaining capacity (*See*, Li, column 5, lines 45-52: "An AL [admit limit] block 44 records the smallest remaining capacity ... among all links ... Block 45 updates the AL block 44 with freshly measured smallest remaining capacity for the entire network ...", emphasis added). This is not the same as dynamically adjusting the per-class resource allocations themselves. It is merely taking a measurement and recording the measurement.

The Applicants made substantially similar arguments regarding the application of Li in the June 1, 2005 response to the Office Action of February 1, 2005. The Examiner did not address these arguments in the Final Office Action or provide any reason as to why such arguments were not persuasive, but merely reiterated the grounds of rejection in the February 1, 2005 Office Action. The Applicants therefore respectfully submit that the arguments previously made in the response of June 1, 2005 still stand and overcome the application of Li to the Applicants' claims. Thus, the Applicants respectfully submit that claims 1, 17 and 20 fully satisfy the requirements of 35 U.S.C. §102 and are patentable thereunder.

Dependent claims 2-3 and 5-9, 13-14, 18-19 and 21 depend from claims 1 and 17 and recite additional features therefore. As such, and for at least the reasons set forth above, the Applicants submit that claims 2-3 and 5-9, 13-14, 18-19 and 21 are not anticipated by the teachings of Li. Therefore, the Applicants submit that dependent claims 2-3 and 5-9, 13-14, 18-19 and 21 also fully satisfy the requirements of 35 U.S.C.

§102 and are patentable thereunder.

III. REJECTION OF CLAIMS 4 AND 10-12 UNDER 35 U.S.C. § 103

1. Claim 4

The Examiner rejected claim 4 under 35 U.S.C. §103(a) as being unpatentable over Li in view of the Nandy patent (United States Patent No. 6,646,988, issued November 11, 2003, hereinafter "Nandy"). The Applicants respectfully traverse the rejection.

Li has been discussed above. Nandy teaches a method for bandwidth allocation in which each packet associated with an "out-of-profile" stream of traffic is assigned a drop precedence. An "out-of-profile" stream is one in which the stream traffic exceeds a target rate. The drop precedence is based on a plurality of factors (including a target rate for the corresponding packet) and defines a priority for dropping packets so-marked.

As discussed, Li fails to teach, show or suggest a method for transmitting packets wherein one or both of a packet class's nominal packet departure rate and the class's minimum allocation of available bandwidth are dynamically changeable, as positively recited by Applicants' independent claim 1. Nandy similarly fails to teach or suggest dynamically adjusting one or both of a packet class's nominal packet departure rate and the class's minimum allocation of available bandwidth; thus, Nandy does not bridge the gap in the teachings of Li. Therefore, the Applicants submit that for at least the reasons set forth above, independent claim 1 fully satisfies the requirements of 35 U.S.C. §103 and is patentable thereunder.

Dependent claim 4 depends from claim 1 and recites additional features therefore. As such, and for at least the reasons set forth above, the Applicants submit that claim 4 is not made obvious by the teachings of Li in view of Nandy. Therefore, the Applicants submit that dependent claim 4 also fully satisfies the requirements of 35 U.S.C. §103 and is patentable thereunder.

2. Claims 10-12

The Examiner rejected claims 10-12 under 35 U.S.C. §103(a) as being unpatentable over Li in view of the in view of the Aatresh patent (United States Patent No. 6,067,301, issued May 23, 2000, hereinafter "Aatresh"). The Applicants respectfully traverse the rejection.

Li has been discussed above. Aatresh teaches a method for forwarding packets from contending queues of a multiport switch to an output of a finite bandwidth. The contending queues are prioritized according to the priorities of the packets being forwarded, and bandwidth is then allocated among the prioritized queues. Any subsequently unconsumed bandwidth is redistributed on a priority basis (*e.g.*, starting with the highest-priority queue).

As discussed, Li fails to teach, show or suggest a method for transmitting packets wherein one or both of a packet class's <u>nominal packet departure rate</u> and the class's <u>minimum allocation of available bandwidth</u> are <u>dynamically changeable</u>, as positively recited by Applicants' independent claim 1. Aatresh similarly fails to teach or suggest <u>dynamically adjusting</u> one or both of a packet class's <u>nominal packet departure rate</u> and the class's <u>minimum allocation of available bandwidth</u>; thus, Aatresh does not bridge the gap in the teachings of Li. Therefore, the Applicants submit that for at least the reasons set forth above, independent claim 1 fully satisfies the requirements of 35 U.S.C. §103 and is patentable thereunder.

Dependent claims 10-12 depend from claim 1 and recite additional features therefore. As such, and for at least the reasons set forth above, the Applicants submit that claims 10-12 are not made obvious by the teachings of Li in view of Aatresh. Therefore, the Applicants submit that dependent claims 10-12 also fully satisfy the requirements of 35 U.S.C. §103 and are patentable thereunder.

<u>IV. CONCLUSION</u>

Thus, the Applicants submit that all of the presented claims now fully satisfy the requirements of 35 U.S.C. §102 and 35 U.S.C. §103. Consequently, the Applicants believe that all the presented claims are presently in condition for allowance.

Accordingly, both reconsideration of this application and its swift passage to issue are earnestly solicited.

If, however, the Examiner believes that there are any unresolved issues requiring the issuance of a final action in any of the claims now pending in the application, it is requested that the Examiner telephone Mr. Kin-Wah Tong, Esq. at (732) 530-9404 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

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